REMARKS

The Office Action rejected claims under 35 U.S.C. §§ 102 and 103. Applicants cancelled claims 4 and 11; amended claims 1, 8 and 15; added new claims 21 and 22; and amended the specification. Claims 1-3, 5-10 and 12-22 remain. Applicants request that the Examiner reconsider and withdraw the rejections.

Information Disclosure Statement

An Information Disclosure Statement accompanies this Amendment as a separate paper.

Drawings

Applicants submit Formal Drawings under separate cover (and by regular mail).

Claim Rejections - 35 U.S.C. § 102

The Office Action rejected claims 1-15 as 20 as being anticipated under 35 U.S.C. § 102(a)[1] over United States Patent Number 6,394,793 to Bunge ("Bunge"). With respect to claims 1-14, Applicants cancelled dependent claims 4 and 11, and inserted such features into independent claims 1 and 8, respectively. Independent claims 1 and 8 now both recite, *inter alia*, a method step of "impingement cooling" a first section of the material. Bunge fails to disclose or to suggest such a feature. While Bunge does describe a forced convection system, Bunge lacks any discussion that the system achieves impingement cooling. Recall that impingement cooling is subset of forced convection with significant higher heat transfer coefficients. In addition, the ranges provided in

[1] The rejection should be under 35 U.S.C. § 102(e), since this reference issued (28 May 2002) after the filing date of the present application (29 November 2001).

Bunge appear to fall outside of the impingement cooling regime. None of the remaining cited references provide a motivation for such a modification. Thus, Applicants request that the Examiner reconsider and withdraw the rejection of claims 1-3, 5-10 and 12-14.

With respect to claims 15 and 20, Applicant modified independent claim 15 to recite that the outlet of the apparatus has a size and a location adjacent the material such that fluid exiting the outlet "impingement cools" the material. Bunge fails to disclose or to suggest this feature. As discussed above, Bunge merely describes a forced convection system, not an impingement cooling system. None of the remaining cited references provide a motivation for such a modification. Thus, Applicants request that the Examiner reconsider and withdraw the rejection of claims 15 and 20.

Claim Rejections - 35 U.S.C. § 103

The Office Action rejected dependent claims 16-19 as being obvious over Bunge. As discussed above, Applicants modified independent claim 15 to define over Bunge. For at least this reason, the Applicant requests that the Examiner reconsider and withdraw the rejection of these dependent claims.

Other Amendments

Applicants made several changes to the specification that were neither made in response to a rejection nor for any substantial reason related to patentability. Specifically, applicant modified paragraph 41 to identify the proper feature and paragraphs 59 and 60 to refer to the proper reference character. These changes do not narrow the scope of the claims nor introduce new matter.

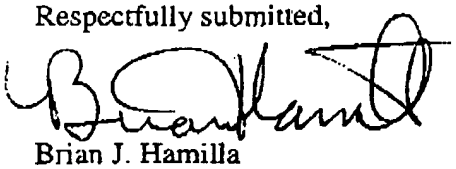
Newly Added Claims

Applicants added new claims 21 and 22. These claims describe inventions that define over the cited references. Applicants did not introduce new matter. Support for these claims appears in the disclosure as originally filed. For example, paragraph 55 of the specification provides support for the newly added claims.

Conclusion

In light of the foregoing, Applicants submit that the case is now in condition for allowance. Applicants request that the Examiner reconsider and withdraw the rejections. Applicants solicit the allowance of claims 1-3, 5-10 and 12-22 at an early date.

Respectfully submitted,



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Attachment "A" – Marked-Up Version Showing Changes

In the Specification:

Paragraphs 41, 59 and 60 were amended as follows.

[0041] Figures 4 and 5 display one of the pipes 109. The pipe 109 is annular to provide axisymmetric cooling to the annular forging F. The ~~tubes 113~~ pipes 109 can be made from any suitable material, such as tooling steel (*e.g.* AMS5042, AMS5062, AISI4340), stainless steel (AISI310, AISI316, 17-4HP), copper and brass. As an example, the pipes 109 could have an inner diameter of between approximately 0.7" and 1.3" and have a suitable thickness. The specific values will depend upon the demands of the quenching process.

[0059] The present invention can locally adjust impingement cooling by varying any of the aforementioned characteristics. For example, one can selectively adjust cooling to desired areas of the forging F by adjusting the diameters of the pipes 109, 117, by adjusting the diameter of the openings 131, by adjusting the size of the spacer 111 or by adjusting the density of the openings 131 (*i.e.* adjust spacing distances X or Y) during the system design stage. During operation of the apparatus 100, one can selectively adjust the cooling to desired areas of the forging F by adjusting pressure in each pipe 109, 114~~7~~, 133. The aforementioned valves on the supply 127 could be used to adjust pressure. Any other technique to adjust pressure could also be used.

[0060] The present invention could leave these characteristics static during the quenching process. In other words, the apparatus 100 could keep the selected pressures in the pipes 109, 114~~7~~, 133 constant throughout the entire temperature range of the quenching process. Alternatively, the present invention could dynamically adjust the pressures in the pipes 109, 114~~7~~, 133 during the quenching

process. For example, the apparatus 100 could operate at a desired pressure until the course grain nickel alloy forging F exits the temperature range of the ductility trough (*e.g.* 1800-2100° F). Thereafter, the apparatus could operate at a reduced pressure for the remainder of the quenching process. Other variations are also possible.

In the Claims:

Claims 4 and 11 were cancelled.

Claims 21 and 22 were newly added.

Claims 1, 8 and 15 were amended as follows.

1. (Once Amended) A method of quenching a material, comprising the steps of:

providing a material having a first section and a second section; and

~~propelling a fluid against~~impingement cooling said first section with a fluid to increase a cooling rate of said first section relative to a cooling rate of said second section.

8. (Once Amended) A method of adjusting the cooling rate of a forging during quenching, comprising the steps of:

providing a forging having a first section with a first cooling rate and a second section having a second cooling rate; and

~~propelling a fluid against~~impingement cooling said first section with a fluid in order to minimize a differential between said first cooling rate and said second cooling rate.

15. (Once Amended) An apparatus for quenching a material, the material having a first section and a second section, said apparatus comprising:

a support for receiving the material; and

an outlet having a size and a location adjacent said support ~~for impinging~~ such that a fluid ~~against~~ exiting said outlet impingement cools the first section of the material, so that a cooling rate of the first section increases relative to a cooling rate of the second section.